



Minutes of the Bering Sea Aleutian Islands Groundfish Plan Team

Alaska Fisheries Science Center, Seattle, WA

September 17-18, 2019

BSAI Groundfish Plan Team Membership:

Steve Barbeaux	AFSC REFM (co-chair)	Andy Kingham	AFSC FMA
Grant Thompson	AFSC REFM (co-chair)	Brenda Norcross	UAF
Steve MacLean*	NPFMC (coordinator)	Kalei Shotwell	AFSC ABL
Mary Furuness	NMFS AKRO	Chris Siddon	ADF&G
Alan Haynie	AFSC REFM	Jane Sullivan	ADF&G
Allan Hicks	IPHC	Cindy Tribuzio	AFSC ABL
Lisa Hillier	WDFW	Vacant	USGWS
Kirstin Holsman	AFSC REFM		

*initial meeting

Administrative

The BSAI Groundfish Plan Team convened on Tuesday, September 17, 2019, at 2:30 p.m.

EBS Pacific cod

Grant Thompson presented the preliminary assessment of the Pacific cod stock in the Eastern Bering Sea with James Thorson listed as a co-author. He began with responses to SSC and Team comments from the previous assessment and noted that ageing bias has been estimated in the assessment for many years. A model-based survey time series for the combined EBS and NBS surveys was estimated along with age compositions, but length compositions could not be created due to computational problems with 1 cm size bins. Additionally, investigations are ongoing to incorporate Russian survey data in model-based indices of abundance data in the assessment.

Models were extended from the current base model (16.6i) to accommodate three hypotheses about the NBS (ignore and focus on EBS only, combine with EBS into a single index, model separate EBS and NBS surveys) and two levels of model complexity (simple and complex). The combined EBS and NBS models used VAST estimates of the index of abundance, while the models associated with the other two hypotheses used design-based estimates (although estimation of VAST model-based indices has now been completed). All models used model-based age compositions. The cold pool was used as a covariate in the model-based estimates of survey abundance. VAST model-based estimates for combined EBS and NBS data were typically similar to the sum of the design-based estimates except in 2014-2016, when the VAST estimates were greater (partially informed by the cold-pool extent). Age compositions were similar for the two methods except for a few trade-offs between estimates at young ages.

Compared to the complex models, the simple models did not perform data weighting or estimate time-varying selectivity, catchability, or mean length at age 1.5, among other specifications. All models for 2019 (19.1-19.6) tuned sigmaR rather than estimating it directly. Additional specifications were investigated and overall 256 models were run before settling on the six new 2019 models.

A bridging analysis was performed to show the effect of sequentially adding or changing data or an assumption. It was noted that the order in which these specifications are bridged may change the perception of important changes, and it is difficult to evaluate complex models without more investigation

to identify which additions are contributing to improvements. Bridging from 16.6i to 19.3 showed a large change when adding fishery age-compositions, but subsequently became more similar to 16.6i as selectivity changes were made. Bridging from the simple 19.3 to the complex 19.4 showed a large change when weighting the data but again approached 19.3 with the inclusion of additional specifications. The fits to survey data improved greatly when estimating yearly random variation in catchability. The six 19.X models showed a range of biomass estimates with the lowest estimated biomass with the EBS-only hypothesis and the largest estimated biomass with the combined EBS and NBS hypothesis. Mohn's rho was large for the complex models, but it was discussed that looking at retrospective plots would be useful to determine if this was influenced by a single peel where a significant portion of the data were removed (e.g., the few recent NBS survey observations). Those plots will be available in November. It was also pointed out that catchability was near 1.0 for the EBS survey in the models with EBS and NBS surveys modeled separately, under-ageing of older fish after 2007 was predicted, and what looks like a large change in the size at age-1 had little effect on the entire growth curve. Recent recruitment was estimated to be low for all models, but the magnitude varied among the models.

An analysis of CPUE data from the fishery did not support the hypothesis that the fish are moving northward during the time of the survey. Plan Team member Alan Haynie mentioned that he and Allen Chen have done similar analyses which also support this conclusion.

There was concern that the truncated survey area for the NBS survey in 2018, covering an area where P. cod CPUE is typically higher, could cause an overinflation of the 2018 survey estimates. This is a benefit of VAST in that the autoregressive spatio-temporal estimates will smooth over those estimates and use data observed in 2017 and 2019 to provide a better estimator for the overall area. It would be useful to compare the design-based estimate of the NBS to the model-based estimates of abundance for only the NBS area. Additionally, it would be useful to see the VAST estimates without the cold-pool variable.

A Team member asked why time-varying selectivity in the survey should be allowed, given standardization of the gear and time-varying catchability is estimated. Statistically, there was support to estimate time-varying selectivity and catchability for the survey. Also, the annual deviations in water temperatures nearshore could be changing the distribution of fish in the surveyed area.

There was some discussion on the use of the ageing bias correction in the model and how growth can be confounded with ageing bias estimation in Stock Synthesis. Grant had explored annually varying K (not included in models presented) and L1.5 (included in the complex models) but their relation to aging bias correction within the model was not explored, except to note that the mean bias at age 1 was virtually constant across models (Model 19.1 being a possible exception), regardless of whether L1.5 was allowed to vary.

The interpretation of Mohn's rho was discussed and it was determined that it may not be a useful diagnostic unless accompanied by retrospective plots. Looking at these model predictions retrospectively involves comparing across the six models as well as across datasets and hypotheses. It does not appear to be appropriate to penalize a model that is attempting to predict movement in and out of the NBS with observations available only for several recent years. Further, the Team was concerned that specific parameters might be driving the retrospective pattern; looking at the retrospective results for specific parameters can aid in interpreting Mohn's rho. Mohn's rho was used as a formal justification for model selection last year, but this does not seem appropriate to use across these model-data combinations for model selection this year across the multiple model hypotheses.

Discussion included the question of whether the EBS-only hypothesis could be removed given: 1) another year of NBS and EBS survey data are now available, 2) young fish are present in the NBS, 3) genetics are similar between the areas, and 4) the longline fishery has been operating in the NBS. Given concerns regarding uncertainty in the connection with Russian waters and the possibility that young fish could have moved into the survey area as a result of warm water nearshore in the NBS, the hypotheses is still useful. It was noted that another survey has been funded to take place in the NBS in 2020, and the support for

this hypothesis may be considered again in the future. It was also noted that this hypothesis could be downweighted if there is less support for it. Therefore, all three hypotheses were carried forward.

It was noted that Grant will be attending the entire NPFMC meeting in October, which leaves little time to complete the assessment before the deadlines for the November Plan Team meeting. With six models (19.1-19.6) being carried forward plus the previous base model (16.6i), it may be challenging to complete too many requests and investigations.

Model Averaging Presentation

Grant also presented a paper that summarized the the cross-conditional decision analysis (CCDA) that he has developed to systematically weight models.

The Team and the SSC have expressed different goals regarding model averaging: the Team wants justifiability and the SSC wants plausibility, which could be interpreted as objective vs. subjective. Objective: weights are computed statistically; subjective: weights are assigned based on relative believability of model structure or results.

There are two problems/challenges of the process: 1) How do you choose ensemble weights, and 2) the quantity of interest (e.g., OFL) is not actually observable. We can't train models on "truth" because we never know the OFL (with hurricanes, we see where they actually go, for example). The CCDA produces a means of balancing these goals.

Grant provided an extensive example in which he examined the method under a risk neutral and a risk-averse scenario. To create this example, Grant developed models that included different covariates and then chose a true model from among them.

The method is different than how we typically manage stocks, but has the desirable balance described above.

While the Team is enthusiastic with the author's progress, the Team and the author agreed that there are likely too many issues to resolve in order to utilize this method in this year's assessment in November.

Given the infeasibility of using the CCDA method in November, the Team discussed alternative means of creating a model ensemble. The Team noted that the largest struggle has been selecting among 2-3 relatively equally feasible models. Thus maintaining the ability to equally weight a subset of models in an ensemble is very appealing for choosing the best model(s).

The Team recommends that:

- **The authors break out the NBS VAST vs empirical in November. (Show separate indices for EBS and NBS using VAST and design-based estimators, along with the combined estimates).**
- **The simple and complex versions of models associated with the 3 developed hypotheses should move forward.**
- **If possible, the authors leave out areas of the NBS (for 2017-2019) for cross-validation of VAST models 19.3 and 19.4 and areas of the EBS. Specifically leaving out the northern portion could be valuable, dependent on the time available.**
- **The 6 19.X models be brought forward in November and the author choose an ensemble if time allows along with appropriate weighting.**
 - **If time does not allow, bring back six 19.X models and an equal weighting average may be attempted by the Team during the Plan Team meeting with the set or a subset of the available models (using code developed for SS ensemble averaging developed by Allan Hicks). The Team recommends that the author provide**

measures of uncertainty for all models so that it would be possible to select ensemble elements and integrate them into a single assessment model.

- **Present retrospective estimates of specific parameters that show retrospective patterns. Steve Barbeaux may help by providing a script to assist with this.**

Regarding the cross-conditional decision analysis (CCDA)

The Team recommends continuing investigation of the CCDA model averaging method, realizing it is unlikely to be implemented this year. The Team is very enthusiastic about this approach. The Team will discuss with the author whether additional input would be useful in further testing and developing the method.

EBS Pollock

Jim Ianelli gave a presentation on the EBS pollock.

Jim began by showing the progress of the fishery for this year. Through the A season, fishing was very good in terms of cumulative catch viewed as a function of fishing time; during the summer B season conditions were poorer. One hypothesis is that the fish were less “schooled up” during the B season than is typically the case.

The bulk of Jim’s presentation was devoted to four ongoing research projects, the results of which are anticipated to be incorporated into the stock assessment at some point, some as early as this year.

1. *Acoustic and bottom trawl survey spatio-temporal modeling—Incorporating vertical distribution in index standardization (Cole Monnahan, lead).* Vertical overlap of the acoustic trawl and bottom trawl likely changes over time. To address this, a new method has been developed that explicitly models the vertical distribution of fish in discrete, spatially-correlated depth strata. These capabilities have been added to the VAST model, which allows inclusion of temporal smoothing and environmental covariates, among other features. As results become available, a model configuration using estimates of the relative availability of pollock between survey gears will be evaluated in the EBS pollock assessment.
2. *Developing environmental indices—retrospective analysis of zooplankton abundance in the Bering Sea pollock stock recruitment models (Ellen Yasumiishi, lead).* The densities of the large copepods, a lipid-rich prey, are linked to the survival of pollock to age-3 (Eisner et al. in prep). The abundance of prey may drive pollock productivity during warm years, when energy demands are high and lipid reserves low. The cold pool index (CPI) for the eastern Bering Sea is a two-dimensional measure of cold (< 2°C) benthic waters on the Eastern Bering Sea shelf observed during the AFSC summer bottom trawl surveys, 1982-2018 (Kotwicki and Lauth 2013, Conner and Lauth 2017). The rationale for this as an environmental index is that cooler summer water temperatures reduce metabolic demands on zooplankton and could increase lipid content. Age-3 pollock from the assessment was compiled along with the $\ln(\text{age-3}/\text{SSB})$ and regressed against the Calanus index and the cold pool index over different length periods (e.g., 1982-2018 and 2002 – 2018). Models were tested using forward model cross validation and retrospective skill testing. The results from these models may be included in this year’s assessment and evaluated along with available survey data.
3. *Estimating groundfish spatio-temporal patterns (Cecilia O’leary, lead).* This year a project was funded to estimate the relative abundance of pollock and other groundfish species in AFSC bottom trawl surveys using Russian TINRO data in the Western Bering Sea. Using these data, the fishing power ratio between these two surveys has been estimated and two versions of a design-based index have been produced. Using design-based CPUEs and eventually spatio-temporal models will allow evaluations of pollock biomass in the EBS compared to the WBS. Future data

requests from TINRO will focus on age- and size-composition and corresponding environmental data. Moving forward, work is focused on developing a model-based index using VAST that combines TINRO and AFSC data. Size composition data from the Russian side are currently unavailable.

4. Survey age-composition estimation consistent with spatiotemporal indices of abundance for use in stock assessment (Cecilia O'leary, lead). In Ianelli et al. (2018) an alternative biomass index based on the VAST approach was included as a sensitivity run. This index was based on VAST. However, the age composition data were still based on the original design-based approach. A spatio-temporal approach has now been developed to obtain age composition estimates to include in the assessment. The second aspect of this work was to develop a model that incorporates all available data sets despite inconsistencies in spatial and temporal coverage (e.g., for years when the survey extended into the northern Bering Sea (NBS)). This study provides an alternative method to calculate indices of abundance and age-composition estimates. The stock assessment model has now been run with both the standard and VAST-developed indices of abundance and age-composition. Design-based and model-based inputs resulted in assessment parameter estimates consistent with previous assessments. A model based on the VAST estimates will be included in this year's assessment, at least as a sensitivity run.

BS/RE Rockfish

Diana Stram and Mary Furuness presented the issue of spatial management of blackspotted/rougeye (BSRE) rockfish in the Aleutian Islands (AI). This stock is managed with a combined Western and Central AI ABC. Additionally, a Maximum Subarea Species Catch (MSSC) is used to guide the industry regarding subarea catches in the WAI and CAI. The MSSC is computed in an identical manner as a subarea ABC. In all but one year since MSSC has been provided, the catches in the WAI have exceeded the MSSC, and in 2019 the WAI catch exceeded 100 tons whereas the MSSC was 37 tons.

The BSAI Plan Team has expressed "strong concern" regarding stock structure, based largely on stock status and demographic information. Further genetic research with advanced methods may help elucidate spatial population connectivity.

The Team recommends that BSRE stock structure research, specifically the planned genetics work outlined in the AFSC Genomics Activity Plan, be highlighted in the Council's Research Priorities.

The Team discussed reviewing subarea ABCs in the future in response to the SSC request to no longer include this portion of the analysis. The Team recognized that the AKRO already prohibits directed fishing for the species in the WAI/CAI when the TAC is reached and a WAI ABC could serve to increase discards, but potentially not reduce catch. Of note, catches of these species are generally retained at high levels, but in 2019 there have been increased discards due to large catches of that are too small to process.

The Team expressed concerns that the use of MSSC is inconsistent with other species where conservation concerns exist and that the use of MSSC has not resulted in achieving its stated purpose. The Team also expressed concerns over the choice between MSSC and subarea ABC prioritizing economics (i.e., forcing regulatory discards) over conservation concerns. The author and members of industry pointed out that fishery data collection methods have changed and may provide improved information to the assessment; however, the age data will not be available for the next full assessment. The Team looks forward to updated research (i.e., modern genomics) to help inform the discussion of the conservation concern, at which time the Team will further continue discussions of subarea ABC.

AI Pacific cod

Ingrid Spies presented a preliminary age-structured assessment for AI Pacific cod.

From 2012 through the preliminary 2016 draft, a total of 22 unique age-structured models were fully vetted in the assessments of AI Pacific cod. However, none of them were accepted by either the Team or SSC for the purpose of recommending harvest specifications. Given that there were so many outstanding issues with respect to the assessments of Pacific cod in both the EBS and AI as of September/October 2016, the Team and SSC recommended suspending efforts to develop an age-structured model of the AI stock until such time as the issues with respect to the EBS assessment had been resolved. In December of 2018, the SSC requested “that an age-structured model be developed” for the AI stock, which prompted Ingrid’s current efforts.

Ingrid showed how fishing increased dramatically in the Aleutian Islands in the 1990s and 2000s, noting that lots of fishing was close to Adak. Area 543 was closed in 2011-2014 and catches have been low since then based on the 2013+ Tier 5 assessments. Ingrid showed that some catches would have exceeded Tier 5 OFL and ABC had they been specified for the years prior to the EBS/AI split.

Data: Fishery catch biomass, size composition, AI bottom trawl survey biomass and age composition.

Ageing criteria for Pacific cod appear to have shifted after 2007; however, all age data used in Ingrid’s model were derived after 2007.

The survey and fishery length compositions are very different, with fishery lengths on average significantly larger. Ingrid noted that the methods of collecting the fishery length-comp data have varied significantly across years.

The proposed model is similar in structure to the age-structured model proposed by Thompson in 2012. Model features include:

- a single season
- one fishery
- AI-specific weight length parameters
- 1 cm length bins to 150cm
- fishery selectivity constant over time
- forced asymptotic fishery selectivity
- survey samples age 1 fish at true 1.5
- ageing bias not estimated
- catchability (q) tuned to match value from archival tagging data relevant to GOA/AI survey net.
- $M=0.4$

There was discussion about possible alternative values of M. For example, $M = 0.66$ in CEATTLE for age 1s. It was concluded that some exploration of alternatives could be useful; for example, it could be fixed at some statistic associated with the prior distribution used in last year’s EBS Pcod assessment.

The Team recommends that the authors report the fit of the maturity curve.

The Team recommends that the authors report an exploration of how different reasonable M values impact reference points.

The Team recommends that the authors report the general results of an existing model that was run without fishery lengths.

The Team recommends that the authors report quantitative goodness of fit statistics.

The Team recommends that the authors communicate with Cindy Tribuzio of AFSC to obtain IPHC survey indices and cod lengths for possible inclusion in future years.

Atka Mackerel

Sandra Lowe presented on using fishery independent and dependent indices for apportionment estimation of BSAI Atka mackerel. For 2018 the stock assessment used the 2018 Aleutian Islands bottom trawl survey data that showed a 21% decrease in biomass for the overall survey area since the 2016 survey, including an 80% drop in biomass for the Central Aleutian Islands (Central AI). Since 2015, a random effects (RE) model has been fit to the bottom trawl survey to determine apportionments for the AI areas (Western, Central, and Eastern). This method would have reduced the Central AI from 34.78% in 2018 to 10% for 2019 (a 71% decrease). Thorough investigation of survey and fishery data were conducted to try to explain the decline, but none was found. One observation is that, in the 2000 and 2018 surveys, the temperatures were relatively constant across the AI, but only one area experienced a large decrease in biomass (Eastern AI in 2000, Central AI in 2018). The fishery catch was not consistent with the survey decrease in the Central AI. The 2019 apportionments were based on the approach used prior to 2016, consisting of an 8:12:18:27 weighted average of the most recent four survey biomass estimates, resulting in a Central AI apportionment of 21% instead of 10%. The SSC and Plan Team requested that the author investigate alternative approaches. The authors' proposed approach uses a RE model following Hulson et al. (in prep), which applies a common process error across regions, allows for multiple indices, with user-specified weighting of the alternative indices. In this application, the indices consist of the survey biomass estimates and mean fishery CPUE. The authors presented five alternative weightings (fishery relative to survey): 1) zero weight, 2) half the weight of the survey index, 3) equal weight to the survey index, 4) double the weight of the survey index, and 5) all the weight given to the fishery CPUE data. This resulted in a range for the Central AI of 10% (no weight on the fishery CPUE index) to 26% if only using the fishery CPUE data. Relative to the four-survey average with between-year weights fixed at the pre-2016 levels, the authors' proposed approach has the advantage that the between-year weights are estimated statistically rather than fixed *a priori*. Potential disadvantages are the need to specify the between-index weights and diluting the impact of the survey index with an alternative index that may not be a good measure of relative biomass. Depending on the between-index weighting, the two approaches can calculate similar apportionments.

When it becomes available, another approach would be to use the VAST model. Currently, the VAST model has some challenges for Atka mackerel in the AI (interpolation across islands; see "VAST" section in Joint GPT minutes).

A Team member noted that the authors' proposed approach was previously applied to AI Pacific cod in 2015 (with the IPHC survey comprising the alternative index), and that neither the author, Team, nor SSC were enthusiastic about the approach at that time.

The Team recommends that the authors investigate the application of median smoothers, the potential for hyperstability within the Atka mackerel fishery to impact this method, the available trip length data, and the potential to develop an objective weighting for the new approach.

Northern Rockfish

Paul Spencer presented methods for calculating length at age for northern rockfish. Current methods do not abundance-weight the otolith data (i.e., they are weighted by sample size), yet there are strong spatial patterns in length at age and abundance: western AI fish are smallest and get larger for a given age eastward, meanwhile most of the population abundance is in the western AI. There were not large differences within an area among years for length-at-age or length-weight relationships, so Paul fit von Bertalanffy curves within each region and combined the abundance-weighted curves to derive global length-at-age values. The Team noted that, while curves were similar between years, they did differ by +/- ~10 cm. Paul pointed out that this may be due to lack of data for young ages.

The Team recommends that Paul uses the abundance-weighted lengths at age.

For next September, the Team requests that the BS and AI survey groups at AFSC present their methods for computing age composition and mean length and weight at age (e.g., is a global mean provided to authors, or is biomass or abundance weighted by area mean?)

Skates BMSY Proxy Discussion

Olav Ormseth presented a discussion of the B_{MSY} assumptions and the appropriateness of those assumptions for the Alaska skate. This was planned as part of last year's presentation, but was not given due to time constraints. Elasmobranchs are equilibrium strategists (i.e., late maturity, low fecundity and high pup survival), which generally have reduced compensatory ability. Thus, species utilizing this life history strategy often have B_{MSY} values greater than the $B_{35\%}=B_{MSY}$ assumption used for Tier 3 species.

The author explored a range of B_{MSY} proxies, from 35%-80%, as well as three catch scenarios: 1) catch set to the maximum ABC, 2) constant F set at the average from 2014-2018, and 3) constant catch set equal to 2018 catch. Each combination of B_{MSY} and catch was run through the standard projection model and SSB examined relative to current B_{MSY} . The author noted that Alaska skate catch is highly correlated with Pacific cod catch, and the constant F scenario is likely the most relevant.

The realized average F for Alaska skate is approximately $F_{50\%}$. At this rate, the spawning biomass is currently above B_{MSY} and projections in the constant catch scenario decrease the spawning biomass to B_{MSY} and then trend along the B_{MSY} value. While the $B_{35\%}=B_{MSY}$ assumption is likely inaccurate for this species, current catch rates and biomass suggest that it is not problematic. It is also unlikely that the true $B_{MSY}=B_{80\%}$, or anywhere close to that value, because current biomass has been relatively stable. If the true B_{MSY} were closer to the upper extreme value, the assessment would already be showing substantial declines in spawning biomass.

The Team requests that the author include this analysis as an appendix in the next full assessment.

2020 and 2021 Harvest specification recommendations

The Team recommends adoption of the 2020 BSAI final OFLs and ABCs published in the harvest specifications (84 FR 9000, March 13, 2019) for the proposed 2020/2021 BSAI OFLs and ABCs for the purpose of notifying the public of potential final harvest specifications.

The Team noted that the Joint Teams recommended that the authors bring forward two alternatives to OFL in November: (1) combine the BS and AI and (2) combine OFL Alaska-wide.

Adjourn

The meeting adjourned at approximately 10:30 am.